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United States Patent [19]

Elmasri et al.

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[54] **TIME INDEX ACCESS STRUCTURE FOR TEMPORAL DATABASES HAVING CONCURRENT MULTIPLE VERSIONS**

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[52] **U.S. Cl.** **395/600;** 395/700; 395/486; 364/419.19; 364/282.1; 364/282.3; 364/DIG. 1

[58] **Field of Search** 395/600, 650, 725, 425; 375/107; 364/419.19

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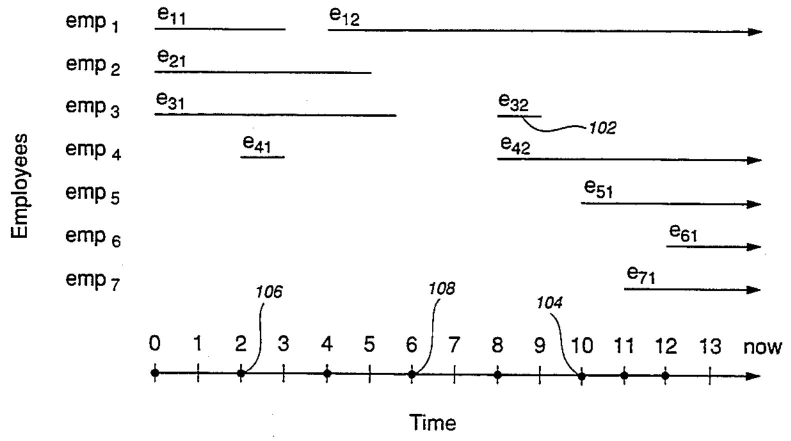
[57] **ABSTRACT**

A time index for temporal databases is provided which enables the retrieval of database object versions that are valid during specified time periods. Unlike prior access and retrieval structures, the present index is based on objects whose search values are time intervals rather than time points. A series of ordered indexing points is defined by the start and end of object version intervals and these points are used to build an indexing structure, which may take the form of a B+-tree. Each leaf node entry of the B+-tree represents an indexing point and has an associated bucket of pointers which identify all object versions that are valid at that time. Storage space is reduced by including only incremental change indicators in the buckets of non-leading leaf entries and calculating needed pointers from such indicators. The time index may be employed in multi-level structures with attribute indexes to greatly improve the efficiency of temporal search operations, such as aggregate functions and temporal selection, as well WHEN and JOIN operators.

14 Claims, 5 Drawing Sheets


Employees
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e12
emp 2
e21
emp 3
e31
e32
102
emp 4
e41
e42
emp 5
e51
emp 6
e61
emp 7
e71
106
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104
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Time